# Expt-1: Routing through Hub, Switch and Router

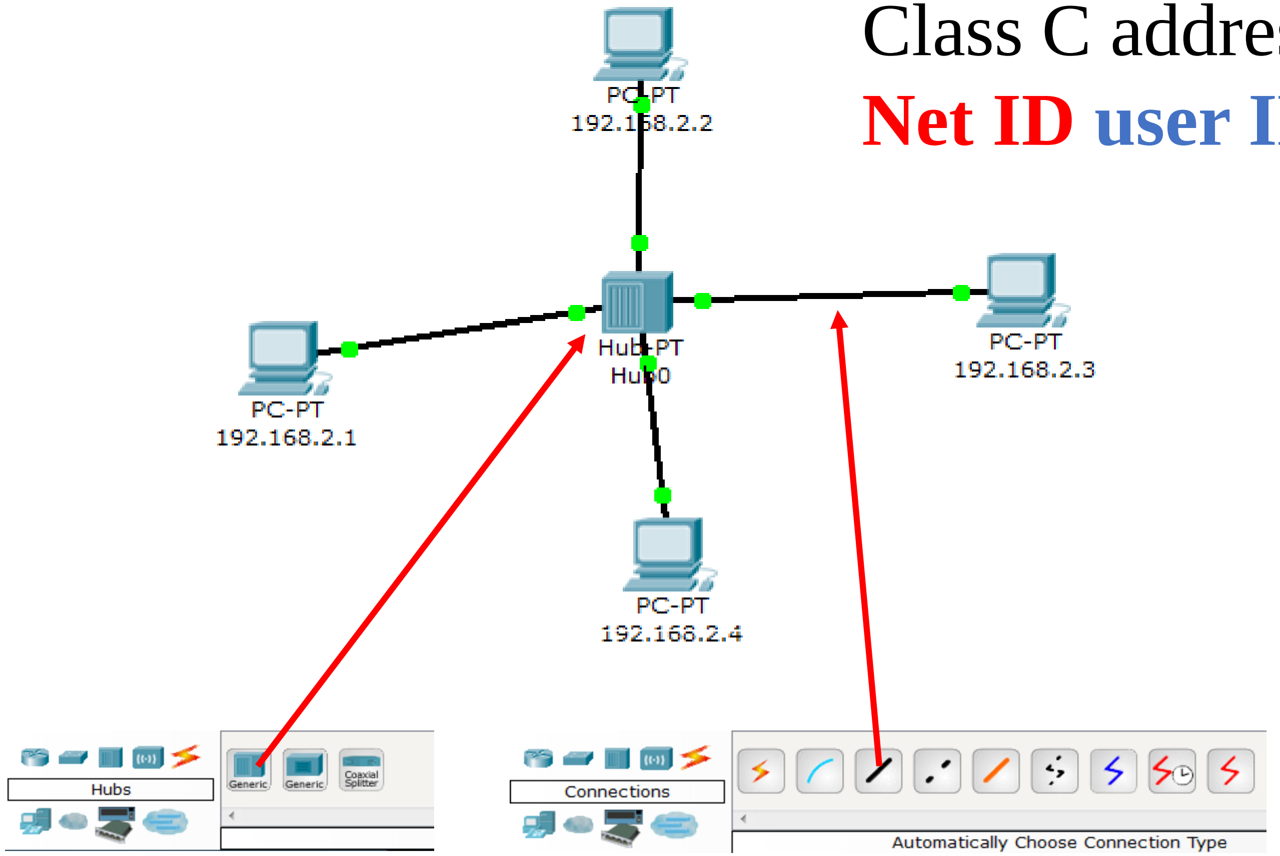
IP address in doted decimal X.Y.Z.Q

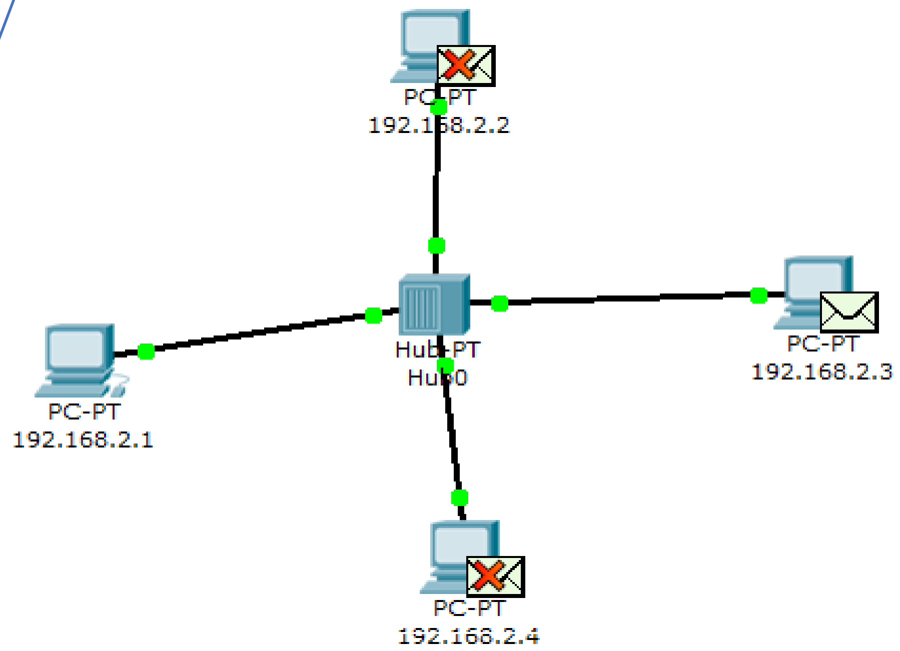
Class C address **X.Y.Z**.**Q**

**Net ID user ID**

0-255

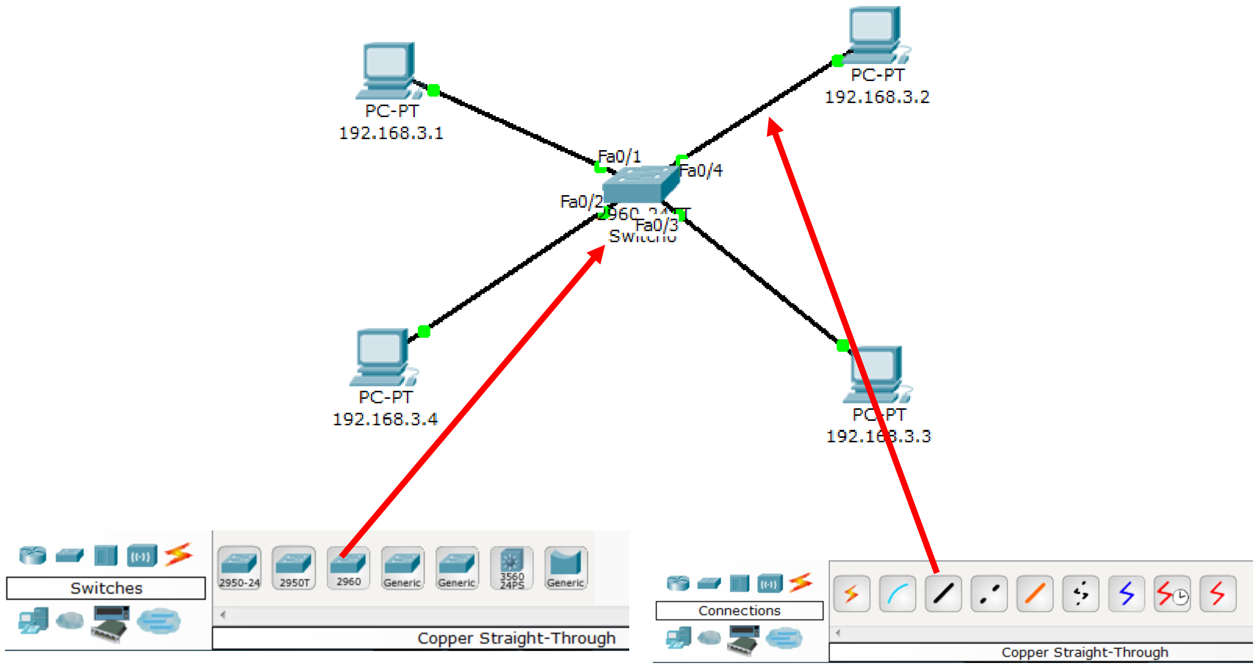
192.168.25.37

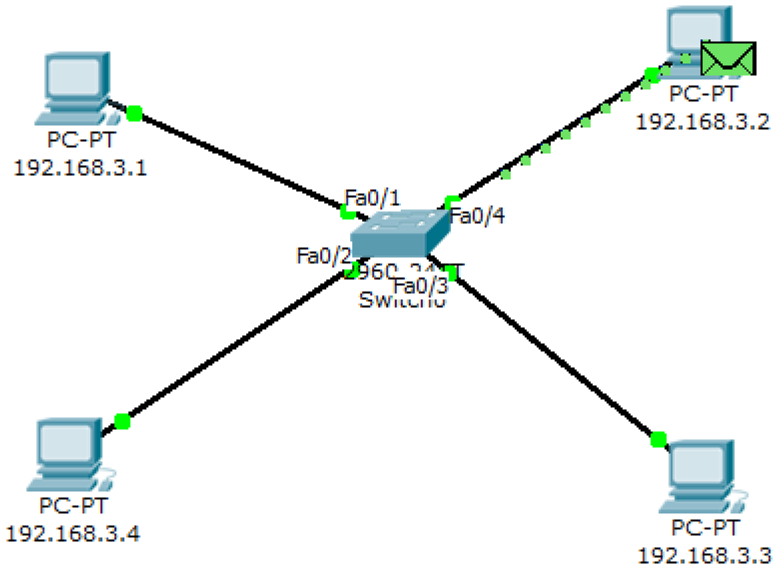


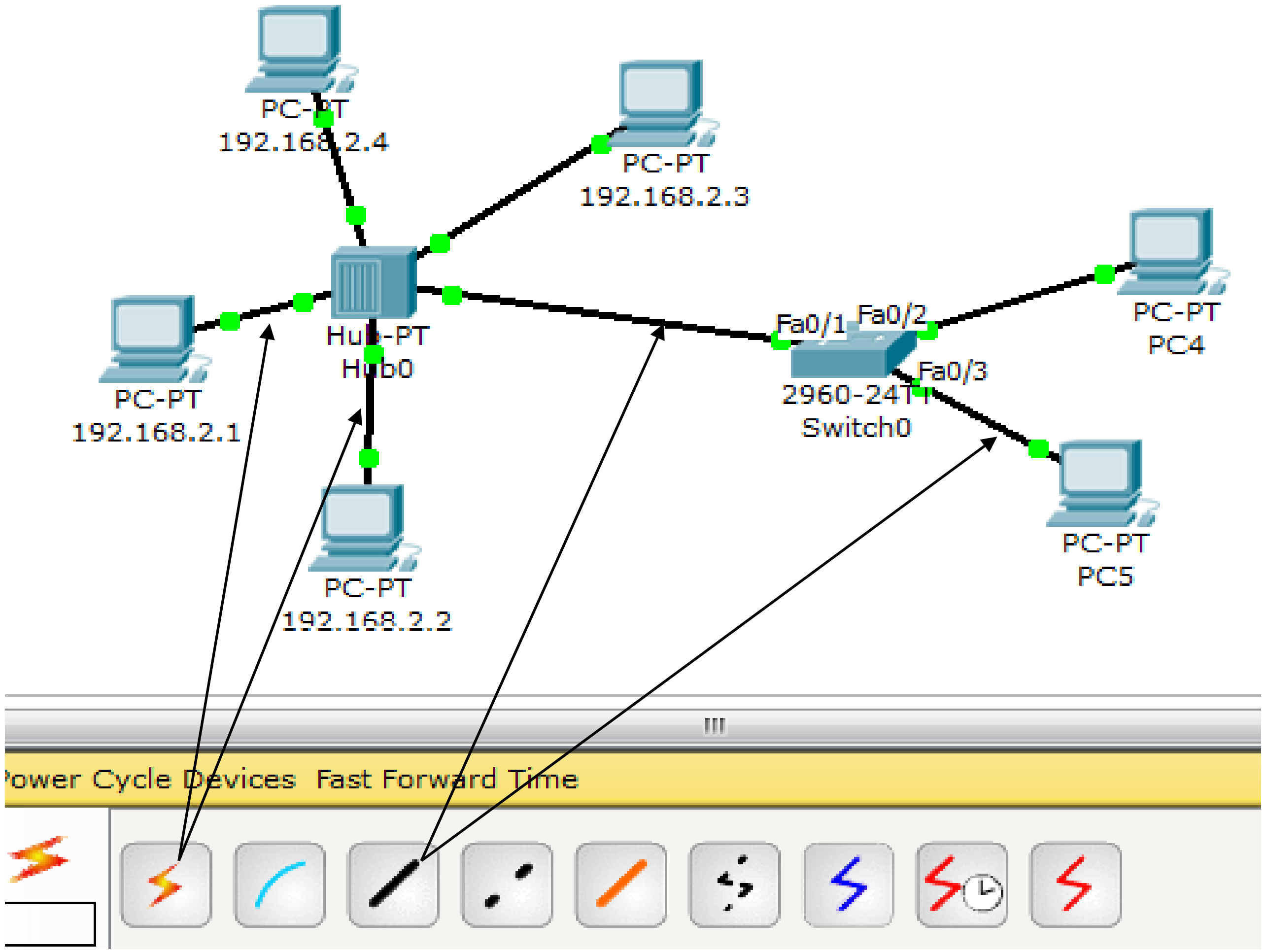




ping **IP address**

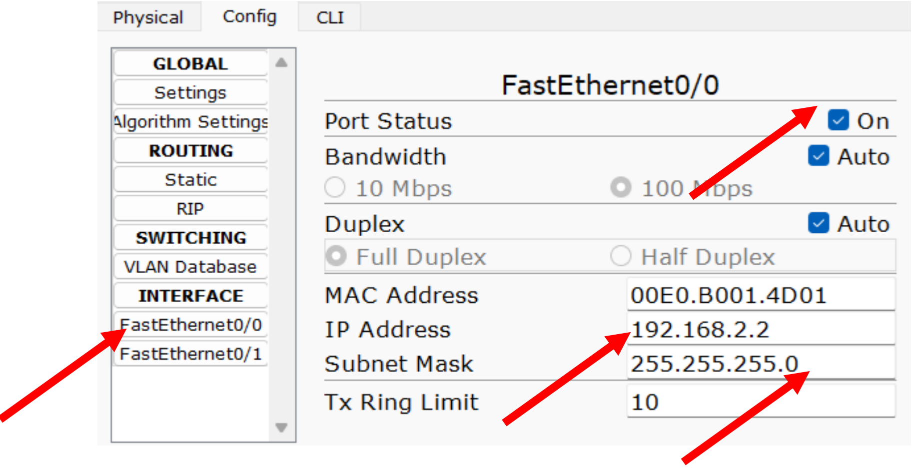
ICMP → Internet Control Message Protocol

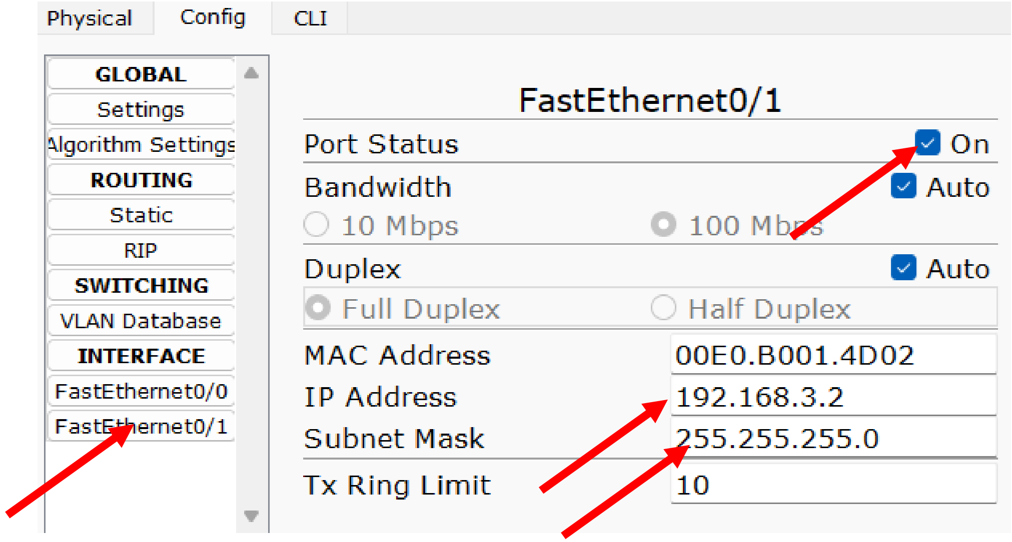

PC-PT
192.168.3.1
PC-PT
192.168.3.2
PC-PT
192.168.3.4
PC-PT
192.168.3.3
Fa0/1
Fa0/4
Fa0/2
Fa0/3
Switches
2950-24
2950T
2960
Generic
Generic
3560 24PS
Generic
Copper Straight-Through
Connections
Copper Straight-Through

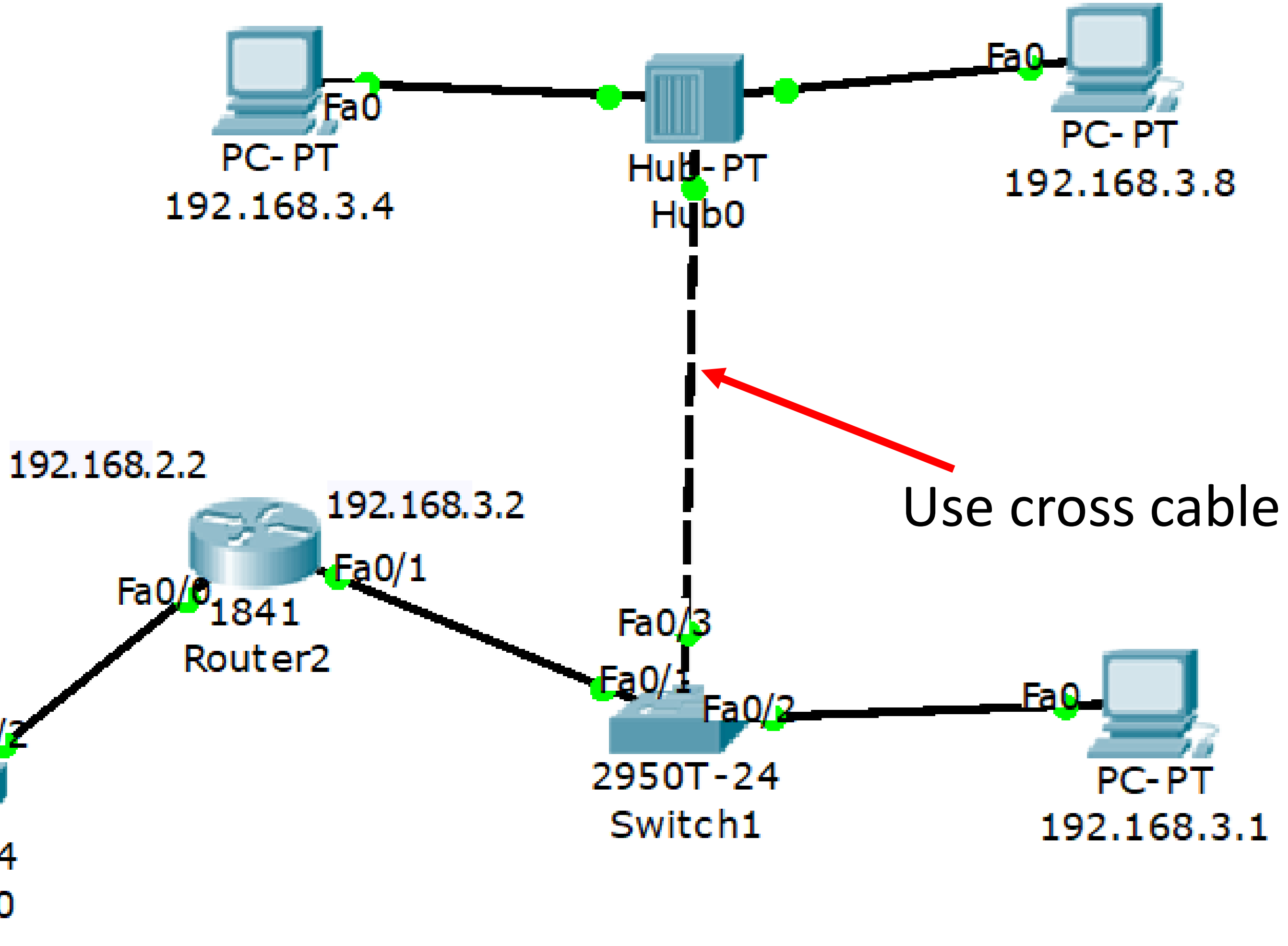

PC-PT
192.168.3.1
PC-PT
192.168.3.2
PC-PT
192.168.3.4
PC-PT
192.168.3.3
Fa0/1
Fa0/4
Fa0/2
Fa0/3

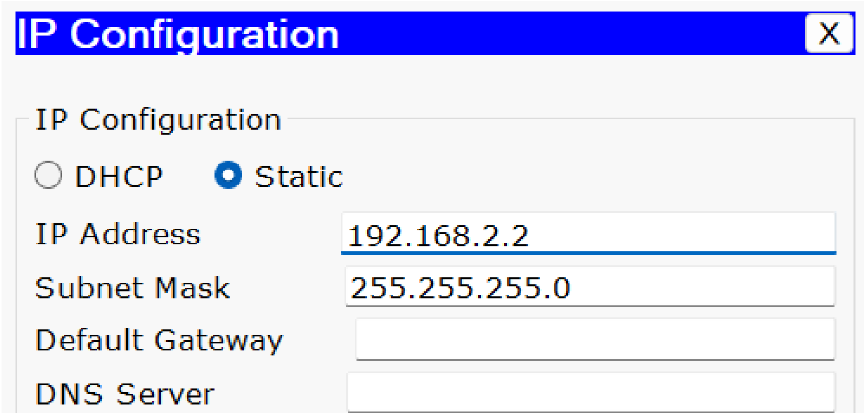

PC-PT
192.168.2.4
PC-PT
192.168.2.3
PC-PT
192.168.2.1
Hub-PT
Hub0
PC-PT
192.168.2.2
Fa0/1
Fa0/2
Fa0/3
2960-24TT
Switch0
PC-PT
PC4
PC-PT
PC5
ower Cycle Devices
Fast Forward Time

# Network with Router, Switch and Hub.

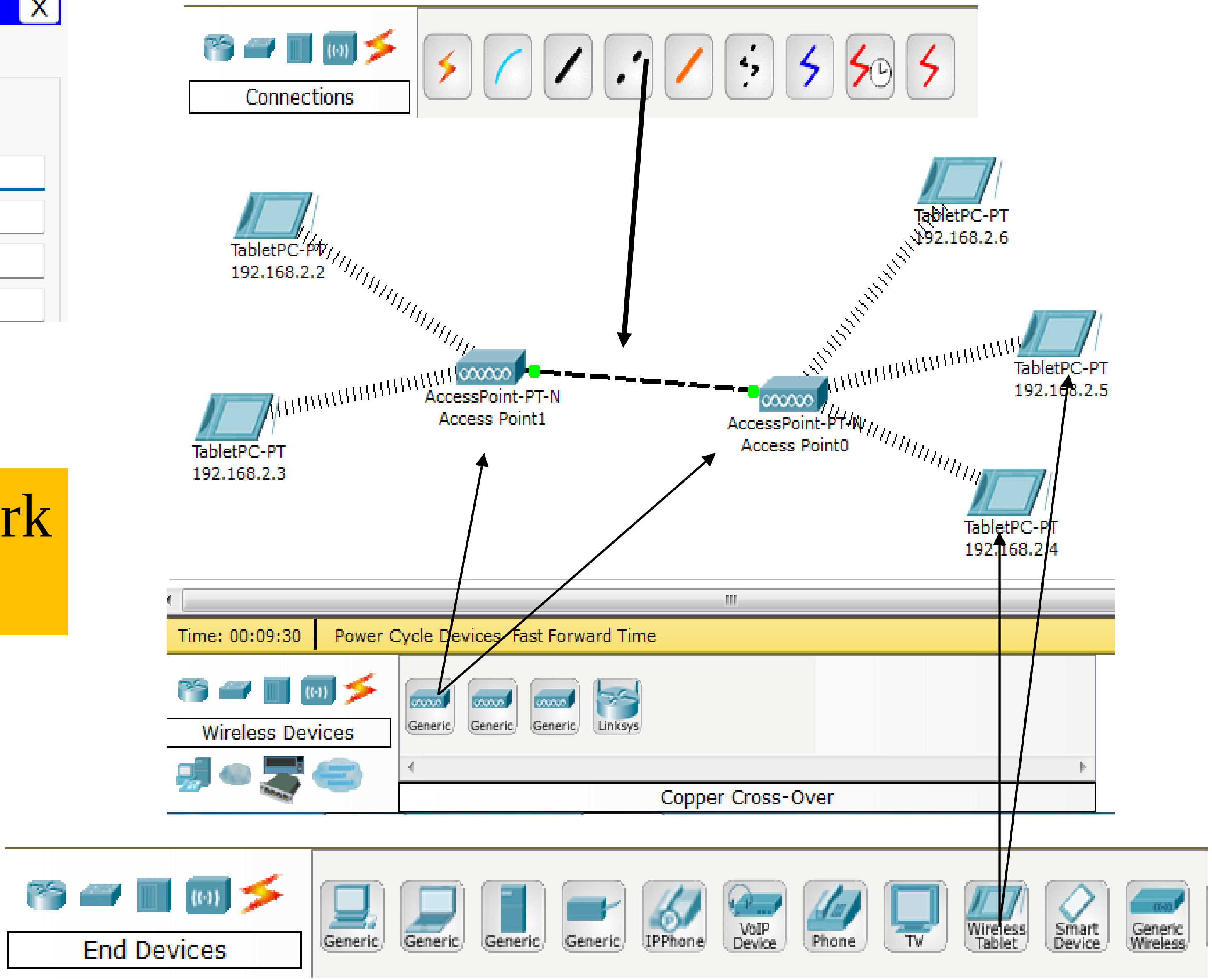


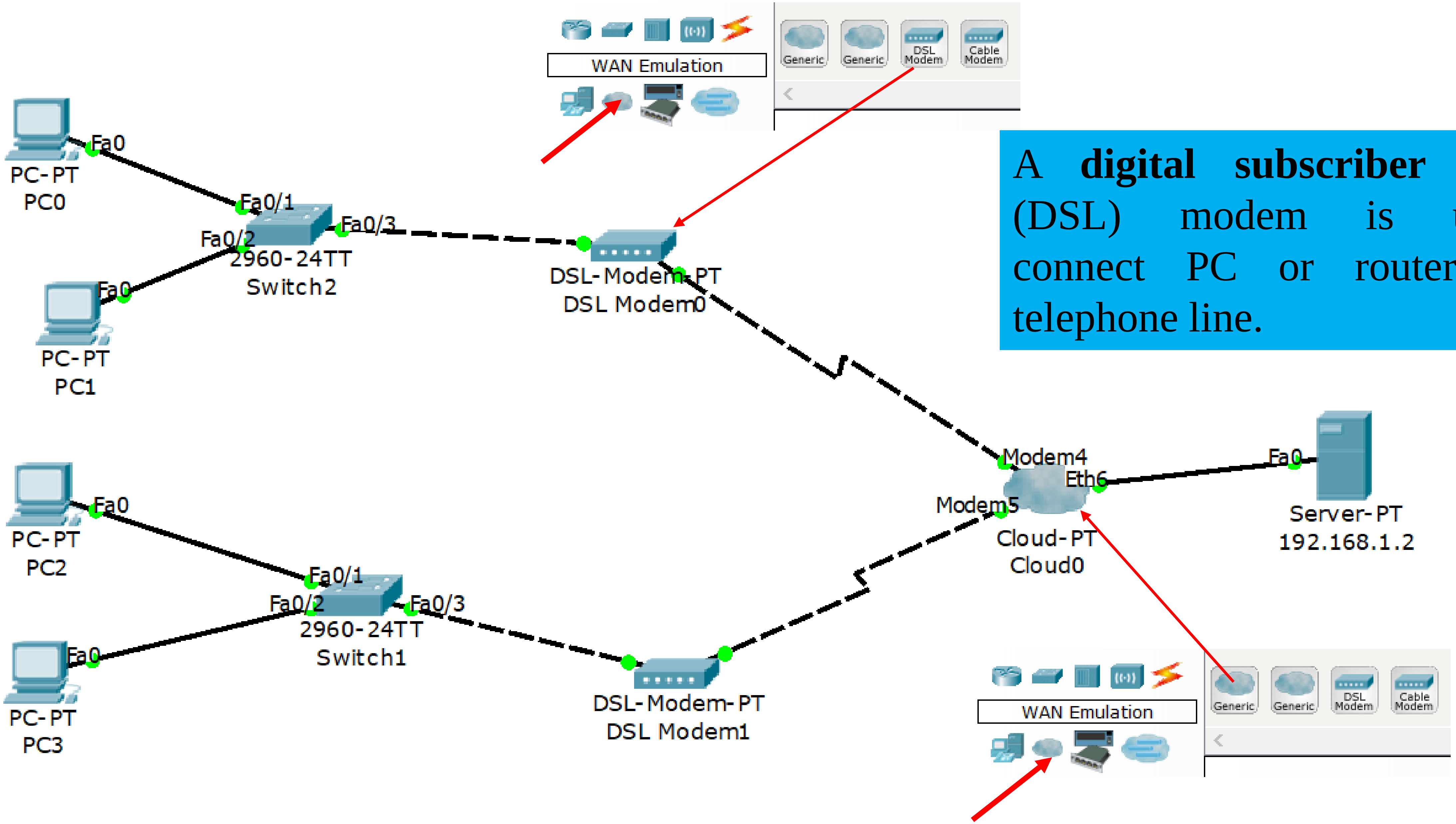





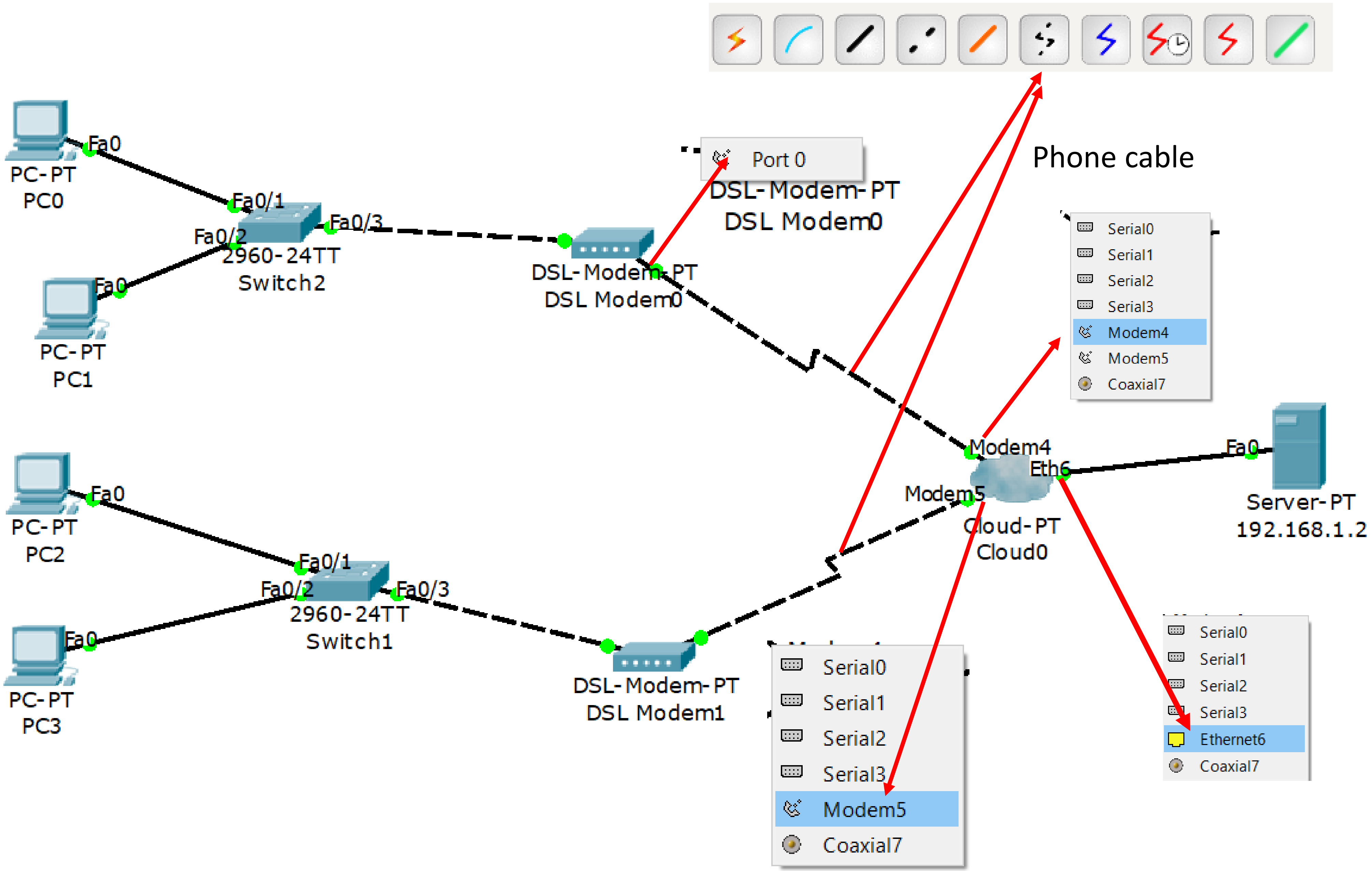

Use static IP, since the network does not have DHCP server.



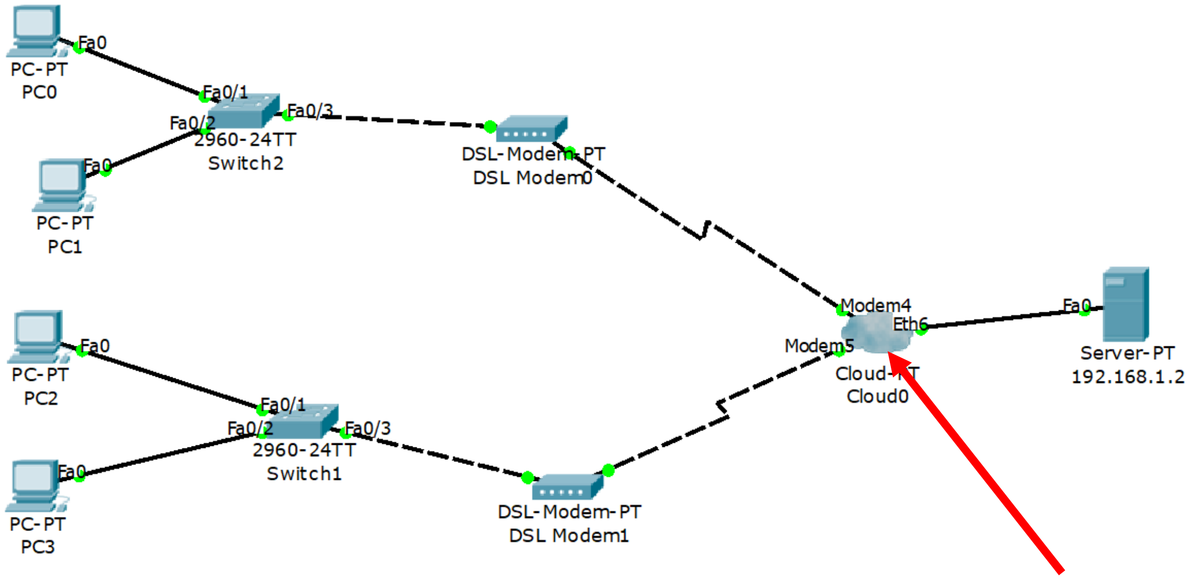
# DSL Modem in WAN

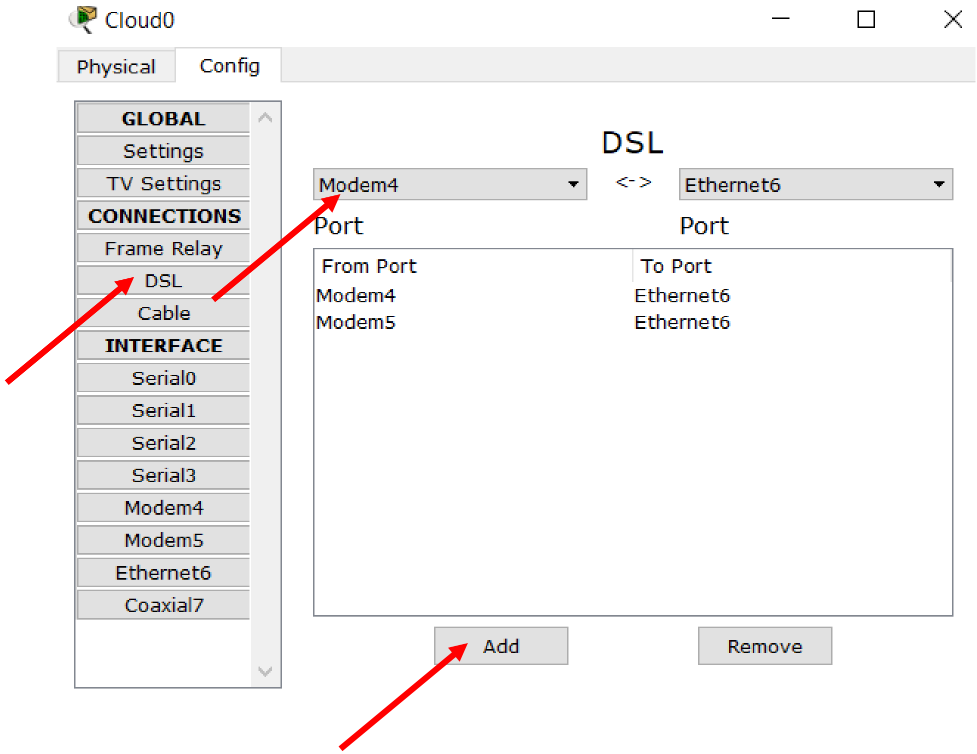


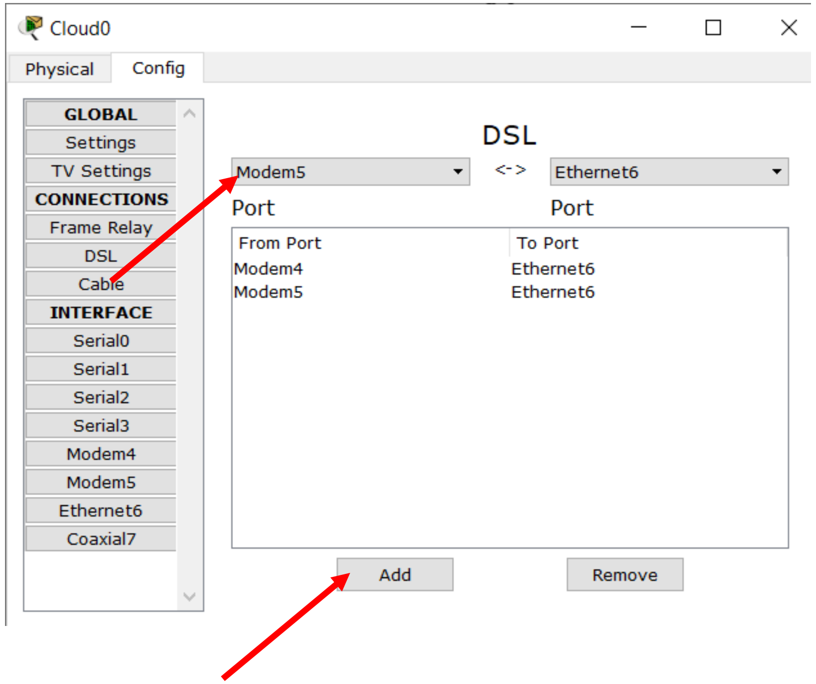

A **digital subscriber line** (DSL) modem is used connect PC or router to telephone line.



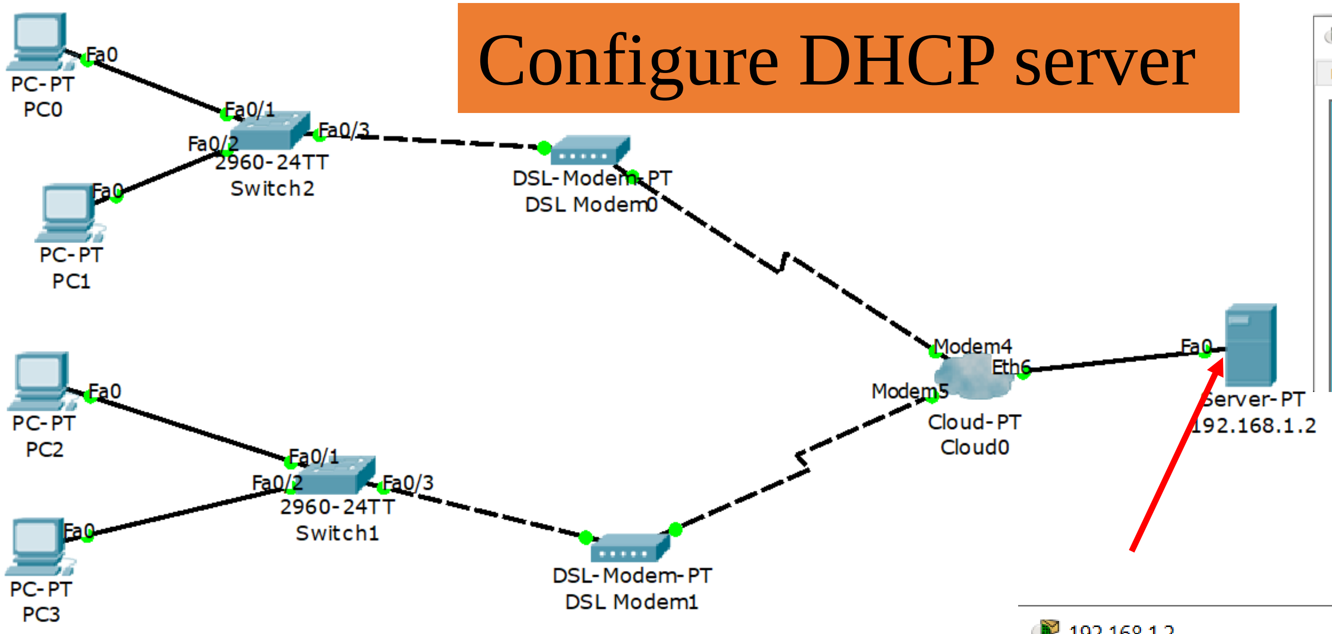
Phone cable
PC-PT
PC0
Fa0
Fa0/1
Fa0/2
Fa0/3
2960-24TT
Switch2
PC-PT
PC1
Port 0
DSL-Modem-PT
DSL Modem0
Serial0
Serial1
Serial2
Serial3
Modem4
Modem5
Coaxial7
Eth6
Cloud-PT
Cloud0
Server-PT
192.168.1.2
PC-PT
PC2
2960-24TT
Switch1
PC-PT
PC3
DSL-Modem-PT
DSL Modem1
Ethernet6

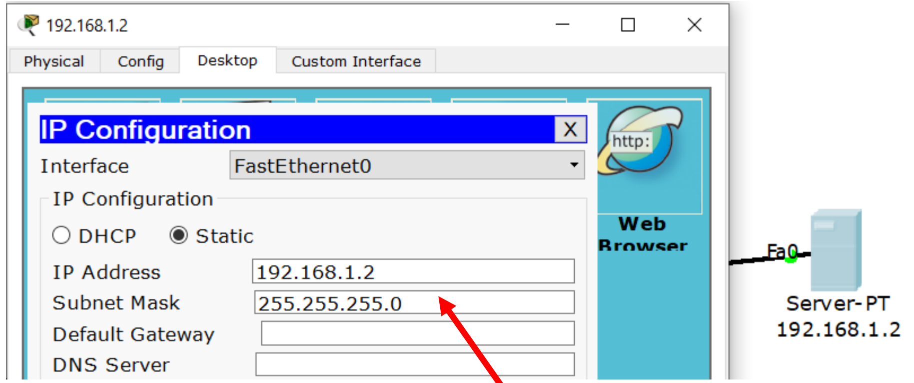

PC-PT
PC0
Fa0
PC-PT
PC1
Fa0
Fa0/1
Fa0/2
Fa0/3
2960-24TT
Switch2
DSL-Modem-PT
DSL Modem0
PC-PT
PC2
Fa0
PC-PT
PC3
Fa0
Fa0/1
Fa0/2
Fa0/3
2960-24TT
Switch1
DSL-Modem-PT
DSL Modem1
Modem4
Eth6
Modem5
Cloud-PT
Cloud0
Fa0
Server-PT
192.168.1.2

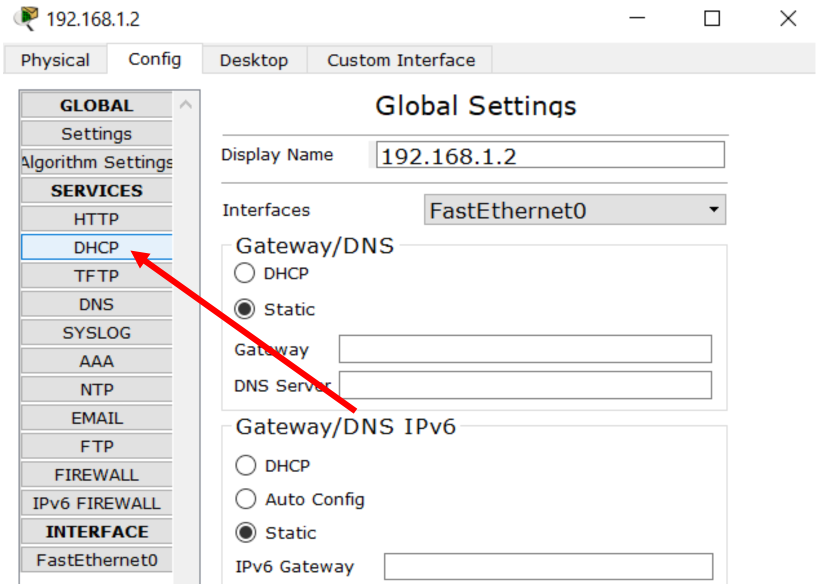

Cloud0
Physical
Config
GLOBAL
Settings
TV Settings
CONNECTIONS
Frame Relay
DSL
Cable
INTERFACE
Serial0
Serial1
Serial2
Serial3
Modem4
Modem5
Ethernet6
Coaxial7
DSL
Modem4
<->
Ethernet6
Port
Port
From Port
To Port
Modem4
Ethernet6
Modem5
Ethernet6
Add
Remove

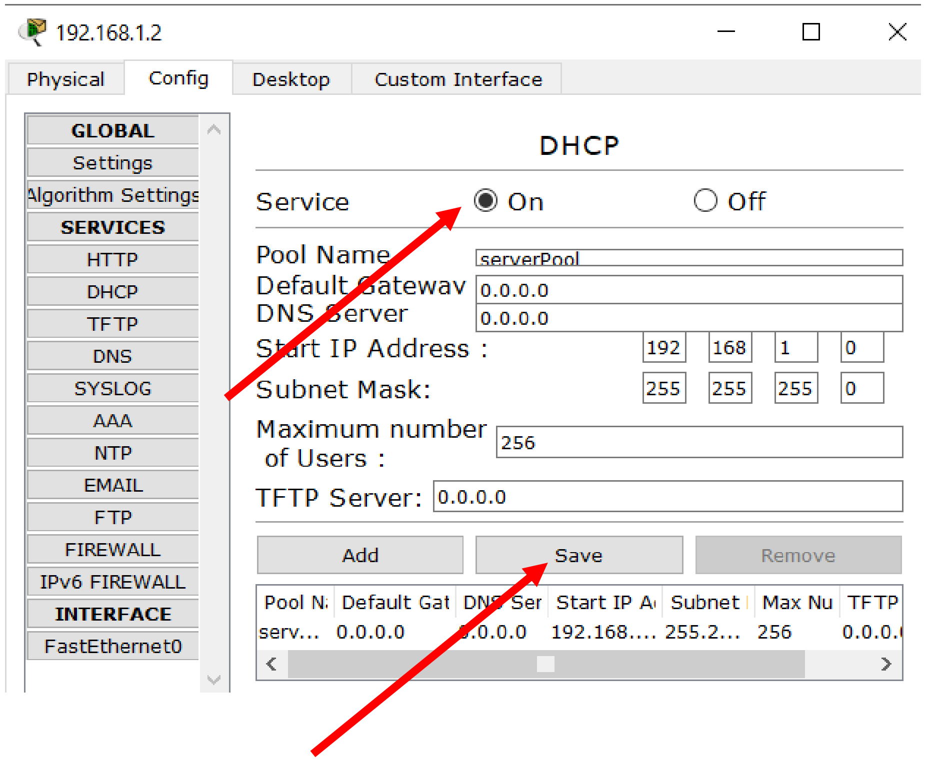

Cloud0
Physical
Config
GLOBAL
Settings
TV Settings
CONNECTIONS
Frame Relay
DSL
Cable
INTERFACE
Serial0
Serial1
Serial2
Serial3
Modem4
Modem5
Ethernet6
Coaxial7
DSL
Modem5
<->
Ethernet6
Port
Port
From Port
To Port
Modem4
Ethernet6
Modem5
Ethernet6
Add
Remove

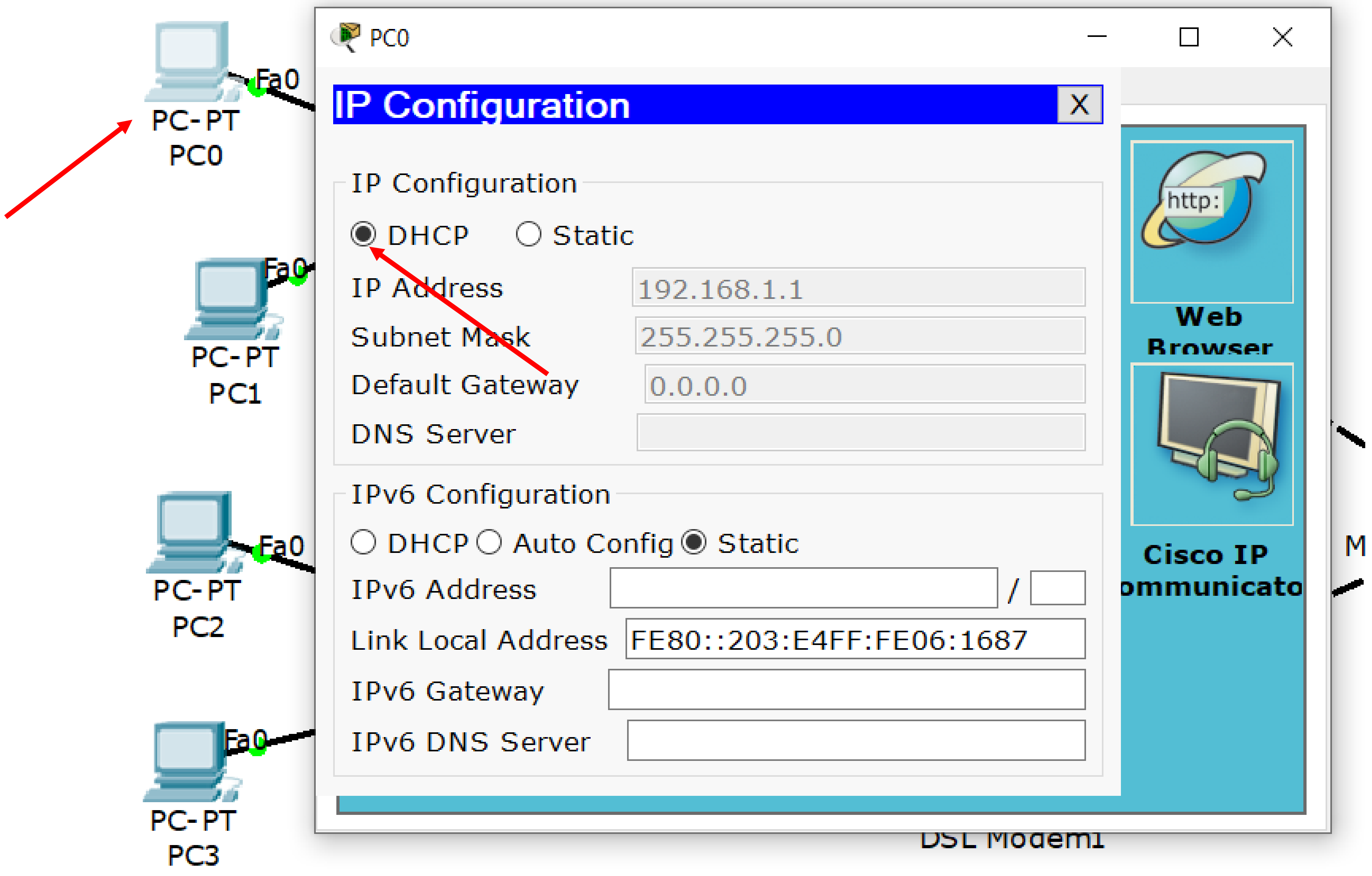
# Configure DHCP server



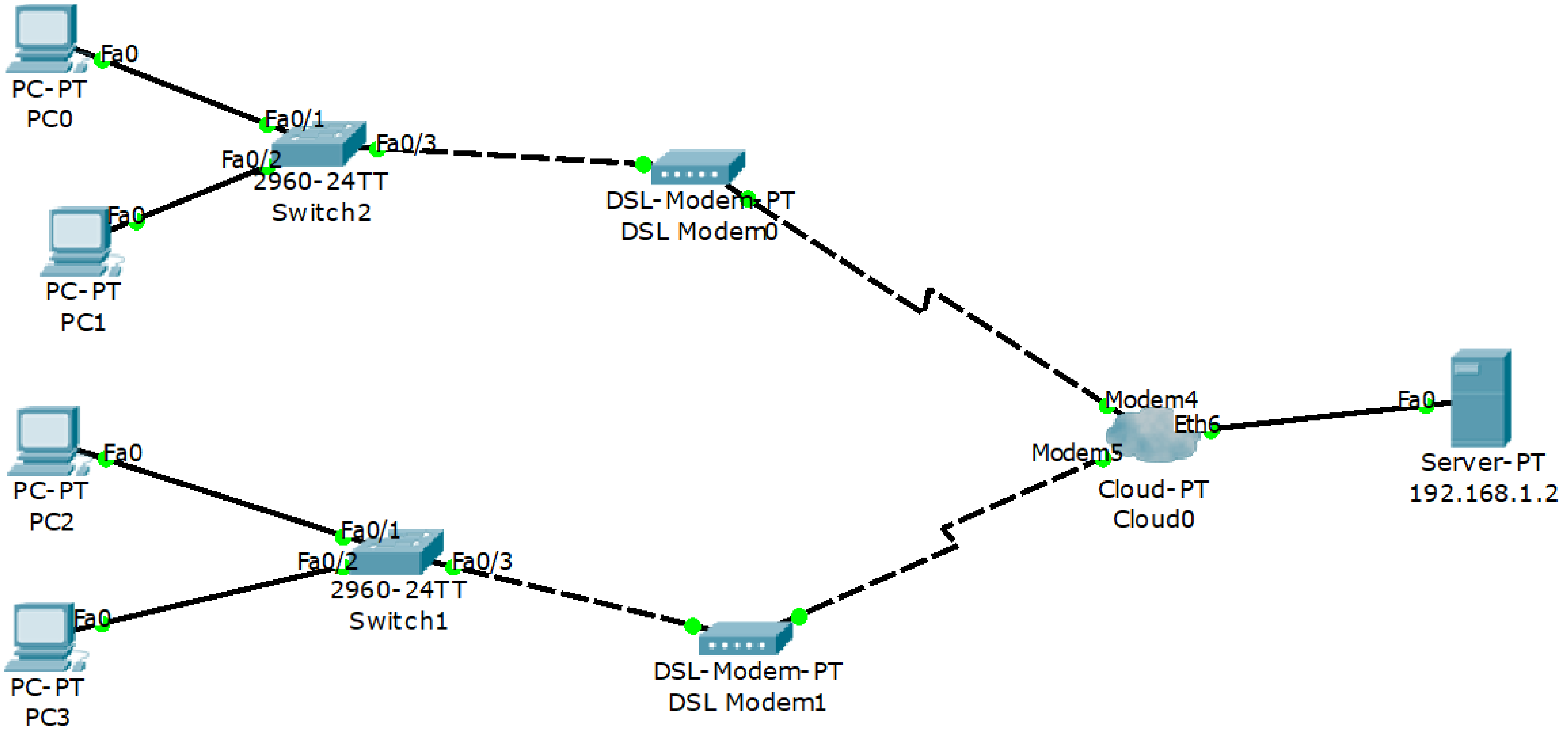



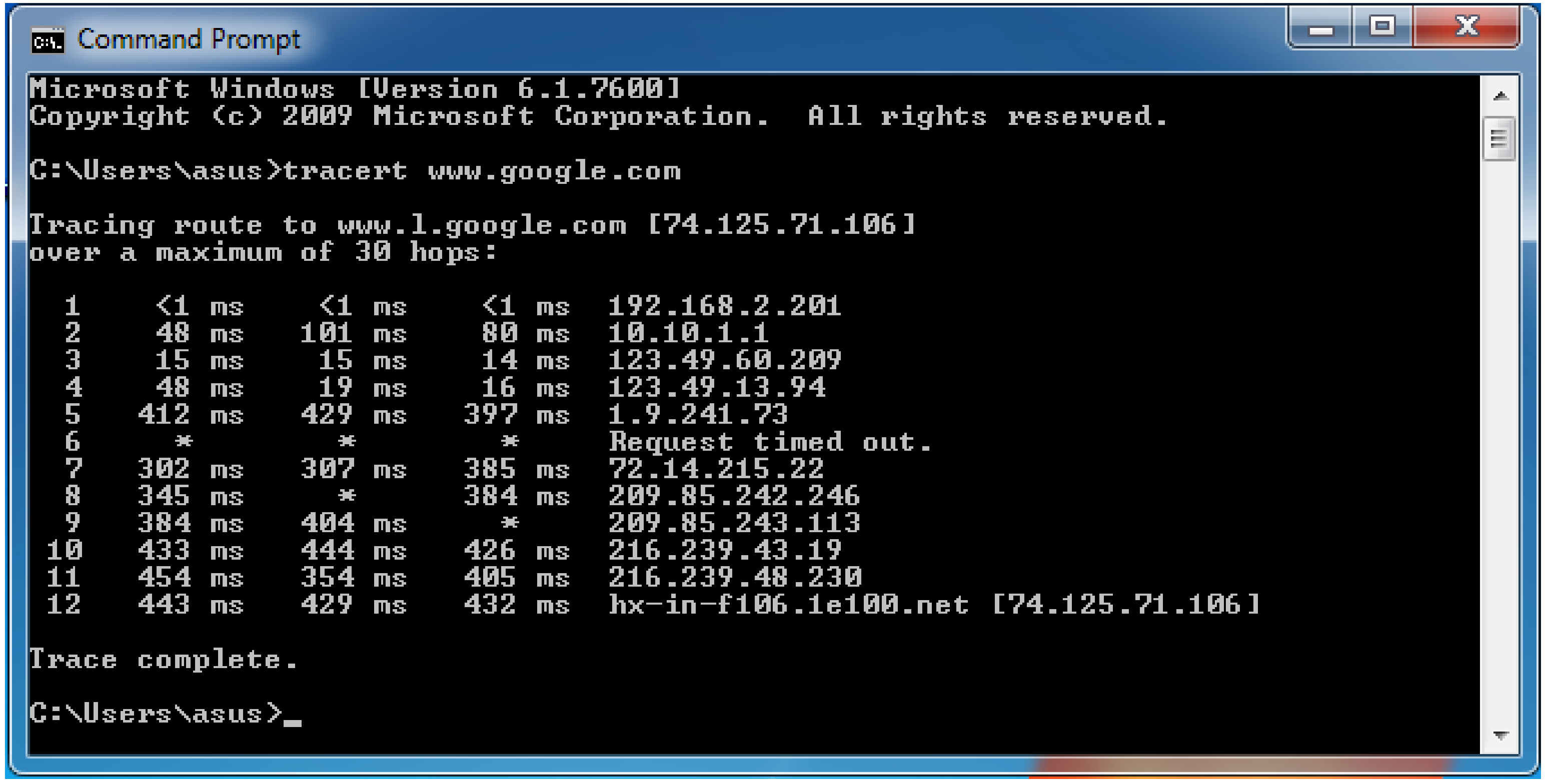

PC-PT
PC0
Fa0
PC-PT
PC1
PC-PT
PC2
PC-PT
PC3
PC0
IP Configuration
IP Configuration
DHCP
Static
IP Address 192.168.1.1
Subnet Mask 255.255.255.0
Default Gateway 0.0.0.0
DNS Server
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
Link Local Address FE80::203:E4FF:FE06:1687
IPv6 Gateway
IPv6 DNS Server
http:
Web
Browser
Cisco IP
ommunicato
DSL Modem1

# Check ICMP packet flow from PC to DHCP server



# Verification of Some Fundamental Command of Network Connections

Using the command ‘*tracert IP address/DNS name*’ on DOS prompt of a machine we can send an ICMP echo packet to the named host. Each hop is tested 3 times (by default) and the corresponding reply time is shown on the DOS prompt of the sender. Figure below shows the time table to reach www.google.com.

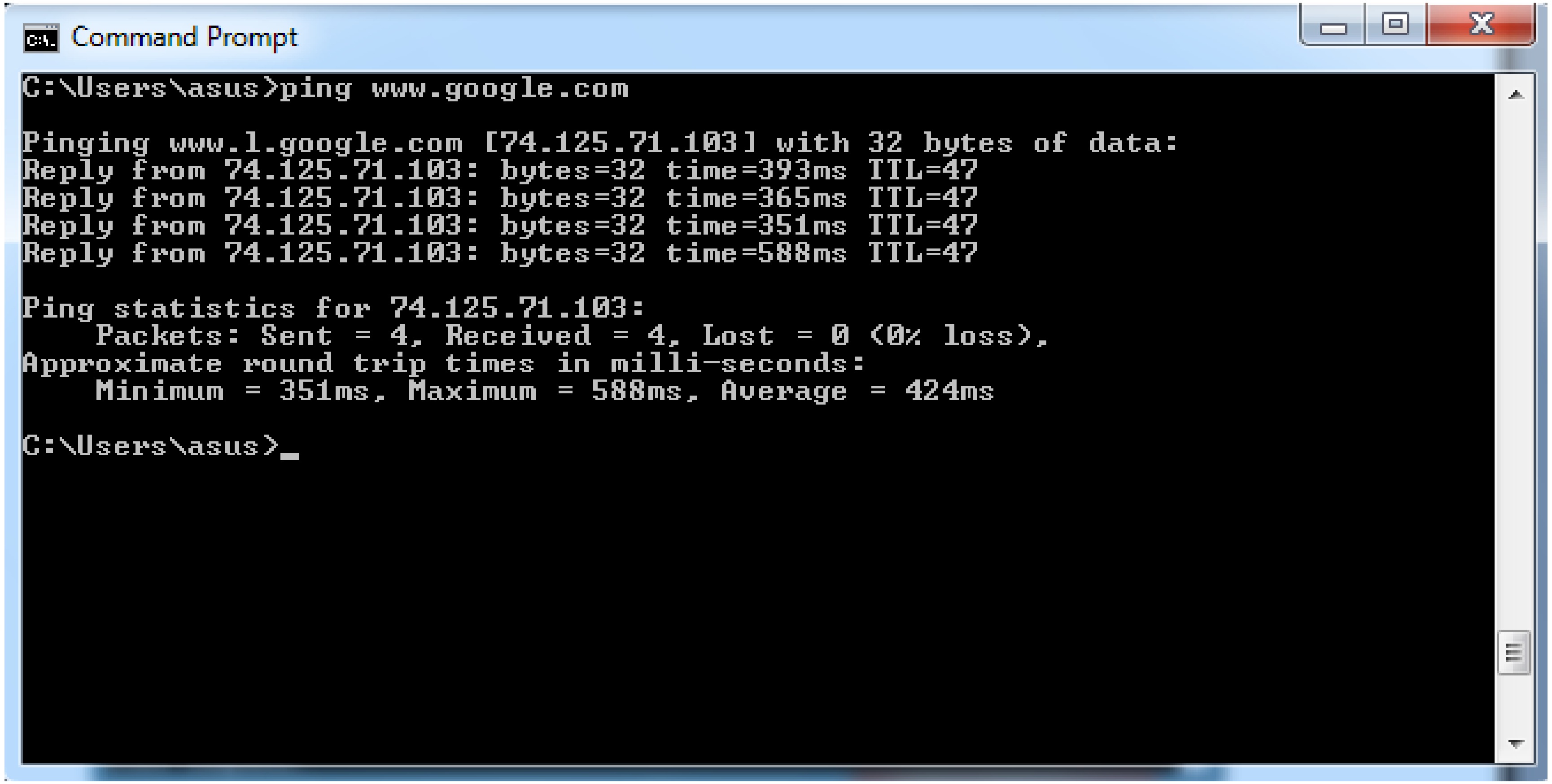


```
Command Prompt
Microsoft Windows [Version 6.1.7600]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\Users\asus>tracert www.google.com

Tracing route to www.l.google.com [74.125.71.106]
over a maximum of 30 hops:

  1    <1 ms    <1 ms    <1 ms  192.168.2.201
  2    48 ms   101 ms    80 ms  10.10.1.1
  3    15 ms    15 ms    14 ms  123.49.60.209
  4    48 ms    19 ms    16 ms  123.49.13.94
  5   412 ms   429 ms   397 ms  1.9.241.73
  6     *        *        *     Request timed out.
  7   302 ms   307 ms   385 ms  72.14.215.22
  8   345 ms     *      384 ms  209.85.242.246
  9   384 ms   404 ms     *     209.85.243.113
 10   433 ms   444 ms   426 ms  216.239.43.19
 11   454 ms   354 ms   405 ms  216.239.48.230
 12   443 ms   429 ms   432 ms  hx-in-f106.1e100.net [74.125.71.106]

Trace complete.

C:\Users\asus>_
```

Let us observe the line 2 as an example where the first attempt took 48ms, the second one took 101 ms, and the third one took 80ms. This variation depends on traffic condition of the link. Some time timeout may occur for a certain router, for example the line 6 of above case. In this case alternate router is selected (72.14.215.22) visualized from line 7.  To get details about the command we can use ‘ *tracert  /?*’

To test the connection between two nodes of a network we can use *ping* command. The details of the command are shown below. Four test packets each of 32 bytes are sent. Ping provides results as the amount of time spent (in milliseconds) between the sending of test packets and receipt of responses. The statistics of time and success rate are also mention at the bottom of the time table.

The result of ping [www.google.com](http://www.google.com) is shown below.



```
Command Prompt
C:\Users\asus>ping www.google.com

Pinging www.l.google.com [74.125.71.103] with 32 bytes of data:
Reply from 74.125.71.103: bytes=32 time=393ms TTL=47
Reply from 74.125.71.103: bytes=32 time=365ms TTL=47
Reply from 74.125.71.103: bytes=32 time=351ms TTL=47
Reply from 74.125.71.103: bytes=32 time=588ms TTL=47

Ping statistics for 74.125.71.103:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 351ms, Maximum = 588ms, Average = 424ms

C:\Users\asus>_
```

# HUB, Bridge Switch and Router

## Hub

- ✓ A hub is the simplest switching devices. Any data packet coming from one port is sent to all other ports. It is then up to the receiving computer to decide if the packet is for it or not.

- ✓ The biggest problem with hubs is their simplicity. Since every packet is sent out to every computer on the network, there is a lot of wasted transmission. This means that the network can easily become flooded. Hubs are typically used on small networks where the amount of data going across the network is never very high.

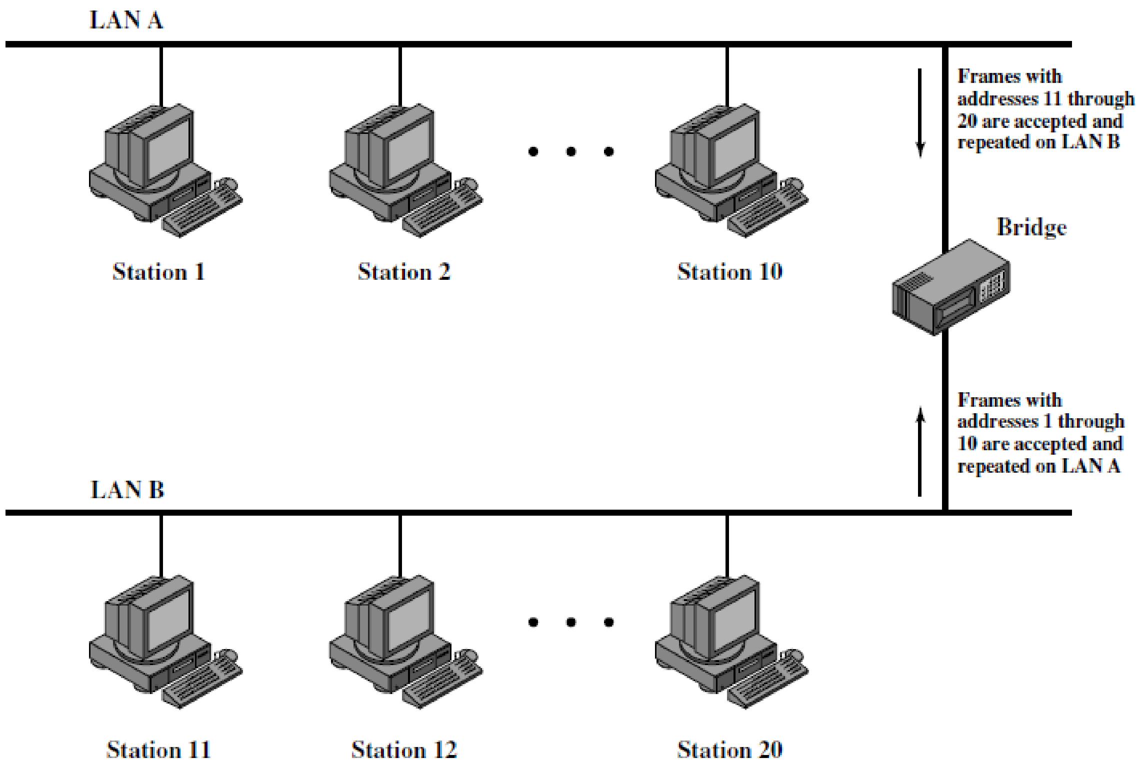
There are mainly two types of hubs:
1. Passive: The signal is forwarded as it is (so it doesn’t need power supply).

2. Active: The signal is amplified, so they work as repeaters. In fact they have been called multiport repeaters (use power supply). Hubs can be connected to other hubs using an uplink port to extend the network.

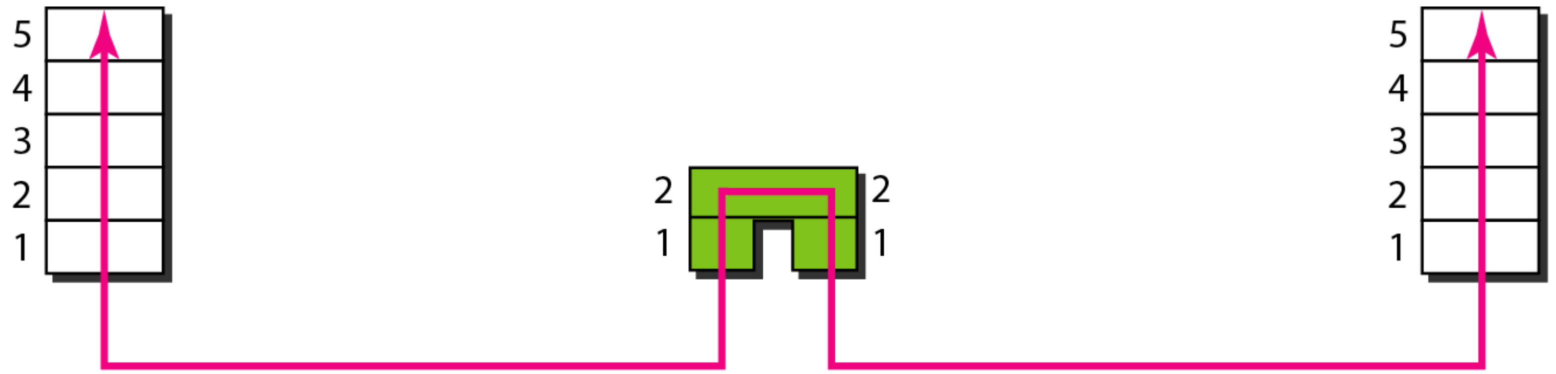
OSI Model: Active Hubs work on the physical layer (lowest layer). That’s the reason they can’t deal with addressing or data filtering. The passive Hub is at layer 0.

# Bridge

A bridge goes one step up on a hub in that it looks at the destination of the packet before sending. If the destination address is not on the other side of the bridge it will not transmit the data. It uses MAC address of 48 bits.

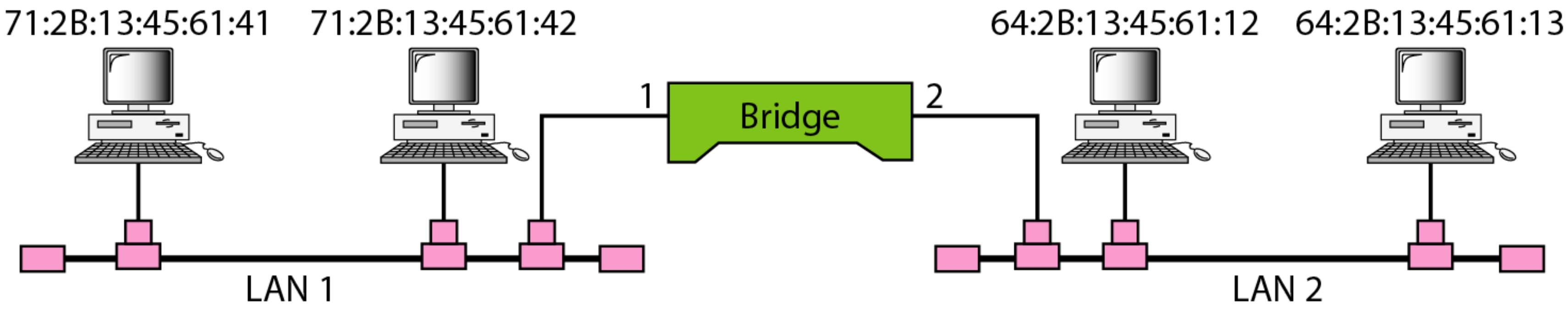


# *A bridge connecting two LANs*




| Address | Port |
|---|---|
| 71:2B:13:45:61:41 | 1 |
| 71:2B:13:45:61:42 | 1 |
| 64:2B:13:45:61:12 | 2 |
| 64:2B:13:45:61:13 | 2 |

Bridge Table



# Switch

Instead of broadcasting the frames everywhere, a layer-2 (works at layer-2 of OSI) switch actually checks for the destination MAC address and forward it to the relevant port to reach that computer only.

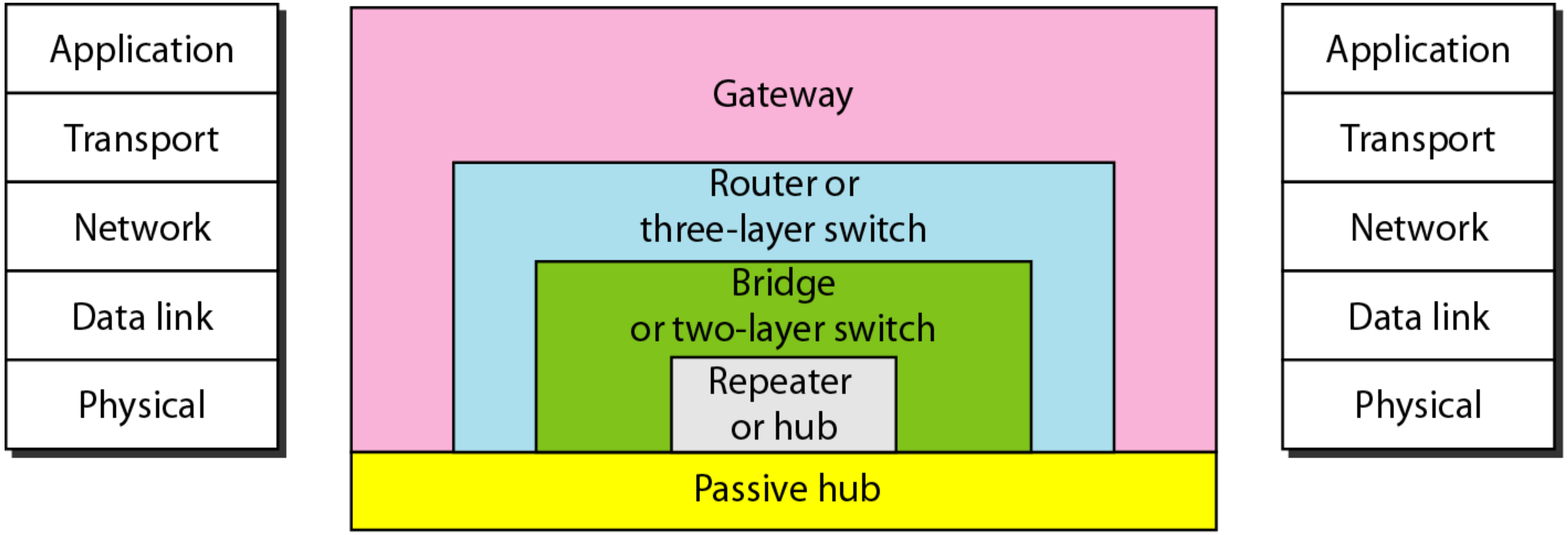
Layer-3 switch works at layer-3 of OSI (can also works at layer-2) and deals with IP address but routes packets on the same types of network for example ethernet to ethernet. In layer-3 switch packet forwarding is done by hardware based routing, whereas router does the job under software based routing. Layer-3 switch is used between two VLAN but layer-2 switch cannot be used between VLANs. Speed of layer-3 switch is higher than the router.

# Router

A router is like a layer-3 switch (router only operates at layer 3 of OSI) but used to connect two or more different networks. It uses software based routing technique and have more options (static routing, dynamic routing, NAT, DHCP server) but slower than layer-3 switch. It has less number of ports compared to switch.


# Gateway

**Gateways** are very intelligent devices or else can be a computer running the appropriate software to connect and translate data between networks with different protocols or architecture, so their work is much more complex than a normal router. For instance, allowing communication between TCP/IP or LTE or 5G.




Five categories of connecting devices